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(22)Date of filing : 03.02.1995 (72)Inventor : KURAMASU KEIZABURO

(54) SURFACE ACOUSTIC WAVE DEVICE AND ITS MANUFACTURE

(57)Abstract:

PURPOSE: To make the size of the surface acoustic wave device used for an electronic device small, to reduce the manufacturing cost and to make the electric characteristic stable.

CONSTITUTION: The surface acoustic wave device is provided with a surface acoustic wave element 1 having an interdigital transducer electrode 3, an extract electrode 4 and an anode adhesion section 5 on its front side and a cover base 6 with an external electrode 10 having a throughhole 9 formed at a position coincident with the extract electrode 4. Then the extract electrode 4 and the external electrode 10 are connected and the cover base and the anode adhesive

section 5 are adhered and sealed.

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CLAIMS

[Claim(s)]

[Claim 1] The surface acoustic wave device which has the anode plate joint which consists of film which uses as a principal component the aluminum which took out on the front face with the INTADIJITARU transducer electrode which excites and receives surface acoustic waves, and was arranged in an electrode and its whole perimeter, It has the external electrode and printing electrode which were prepared in the through tube made in the location which is in agreement with the ejection electrode of said surface acoustic wave device. And surface-acoustic-waves equipment characterized by having equipped said surface acoustic wave device and the field which counters with the insulating covering substrate which made the opening section, and having joined said ejection electrode and said external electrode electrically, and having joined said covering substrate and said anode plate joint, and closing.

[Claim 2] The surface acoustic wave device which has the anode plate joint which consists of film which uses as a principal component the aluminum which took out on the front face with the INTADIJITARU transducer electrode which excites and receives surface acoustic waves, and was arranged in an electrode and its whole perimeter, It has the external electrode prepared in the through tube made in the location which is in agreement with the ejection electrode of said surface acoustic wave device. And said surface acoustic wave device and the field which counters are equipped with the insulating covering substrate which made the opening section. Join said ejection electrode and said external electrode electrically, and said covering substrate and said anode plate joint are joined and closed. Surface-acoustic-waves equipment characterized by having covered the electromagnetic shielding film on the external surface of said surface acoustic wave device, and packing the whole by mold resin after joining a lead terminal to said external electrode.

[Claim 3] The surface acoustic wave device which has the anode plate joint

which consists of film which uses as a principal component the aluminum which took out on the front face with the INTADIJITARU transducer electrode which excites and receives surface acoustic waves, and was arranged in an electrode and its whole perimeter, It has the insulating covering substrate which has the external electrode prepared in the through tube made in the location which is in agreement with the ejection electrode of said surface acoustic wave device. Surface-acoustic-waves equipment characterized by having joined said ejection electrode and said external electrode electrically, and having joined and closed said covering substrate and said anode plate joint, and covering the electromagnetic shielding film on the external surface of said surface acoustic wave device.

[Claim 4] Many surface acoustic wave devices which have the anode plate joint which consists of film which uses as a principal component the aluminum which took out on the front face with the INTADIJITARU transducer electrode which excites and receives surface acoustic waves, and was arranged in an electrode and its whole perimeter are arranged. And the process which creates the component formation substrate which has the anode plate junction terminal which said all anode plate joints were connected, and it was pulled out by the field in which said surface acoustic wave device is not formed, and was prepared, The process which creates the covering substrate formation glass plate which has the through tube of a large number made in the location which is in agreement with each ejection electrode of said surface acoustic wave device, After carrying out alignment of the ejection electrode of said component formation substrate, and the through tube of said covering substrate formation glass plate and sticking them, the whole is heated while impressing an electrical potential difference between the anode plate junction terminals of said covering substrate formation glass plate and said component formation substrate. The process which bundles up the anode plate joint of said surface acoustic wave device, and is joined to said covering substrate formation glass plate, and said component formation substrate subsequently joined and said covering substrate

formation glass plate by sputtering in the inside of vacuum devices The through tube of said covering substrate formation glass plate, the process which forms an external electrode in the periphery, the process which forms the printing electrode subsequently to said external electrode connected with an external circuit, and the manufacture approach of surface-acoustic-waves equipment of subsequently having the process of said anode plate joint which cuts a core mostly.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the surface-acoustic-waves equipment used for mobile communication equipment, such as television, VTR, and a cellular phone, and its manufacture approach.
[0002]
[Description of the Prior Art] Conventional surface-acoustic-waves equipment is explained below.
[0003] As shown in drawing 9 , generally, on the single crystal substrate 21 of a

piezo electric crystal, a surface acoustic wave device 20 has the ejection electrode 23 for energizing a surface wave to the INTADIJITARU transducer (henceforth IDT) electrode 22 and the IDT electrode 22 with the function excited and received, and is being equipped with and fixed with die bond resin 26 on the ground electrode 25 of a stem 24. The ejection electrode 23 and the terminal electrode 27 are electrically connected by the wire bond method with the aluminum wire 28 for connection. In addition, it may replace with the aluminum wire 28 and Au wire may be used. The terminal electrode 27 is the configuration which connects with the terminal 29 and can be connected with an external circuit.

[0004] Since surface-acoustic-waves equipment uses the propagation property of a surface wave, it cannot cover a front face with a protective coat, but is considering it as the configuration which has space on the front face of the IDT electrode 22. That is, it is the configuration which put the cap 30 considered as the configuration which does not contact a surface acoustic wave device 20 and the aluminum wire 28, and maintains the exterior and an airtight, carried out the seam welding of the periphery, formed the seam welding section 31, and was closed.

[0005]

[Problem(s) to be Solved by the Invention] However, although it is reliable, since it cannot weld collectively by the closure by seam welding with the above-mentioned conventional configuration With heating when mounting the trouble that a man day starts and a manufacturing cost becomes high, and surface-acoustic-waves equipment in a printed circuit board Further, the trouble of gas being emitted from die bond resin 26, and changing frequency characteristics, and when using it in a high frequency band The aluminum wire 28 acted as an inductor, and since the inductance changed with how to stretch the aluminum wire 28, it had the trouble that frequency characteristics were unstable.

[0006] This invention solves the above-mentioned conventional trouble, a manufacturing cost is cheap and frequency characteristics aim at not changing

but offering the surface-acoustic-waves equipment and its manufacture approach of the stable property.

[0007]

[Means for Solving the Problem] It considers as the configuration which was equipped with the covering substrate made from a glass plate which has the external electrode which prepared in the through tube which made in the surface acoustic wave device which takes out the surface-acoustic-waves equipment of this invention on a front face with the IDT electrode which excites and receives surface acoustic waves, and has an electrode and an anode plate joint, and the location which are in agreement with the ejection electrode of a surface acoustic wave device in order to attain this purpose, and connected an ejection electrode and an external electrode electrically, and joined a glass substrate and an anode plate joint and closed an IDT electrode.

[0008] Moreover, the manufacture approach arranges many surface acoustic wave devices which have the anode plate joint which consists of film which uses as a principal component the aluminum which took out on the front face with the IDT electrode which excites and receives surface acoustic waves, and was arranged in an electrode and its whole perimeter. And the process which creates the component formation substrate which has the anode plate junction terminal which all anode plate joints were connected, and it was pulled out by the field in which the surface acoustic wave device is not formed, and was prepared, The process which creates the covering substrate formation glass plate which has the through tube of a large number made in the location which is in agreement with each ejection electrode of a surface acoustic wave device, After carrying out alignment of the ejection electrode of a component formation substrate, and the through tube of a covering substrate formation glass plate and sticking them, The process which heats the whole, bundles up the anode plate joint of a surface acoustic wave device, and is joined to a covering substrate formation glass plate while impressing an electrical potential difference between a covering substrate formation glass plate and an anode plate joint, The component formation

substrate and covering substrate formation glass plate which were joined subsequently, by sputtering in the inside of vacuum devices Subsequently it has the process of an anode plate joint which cuts a core mostly with the through tube of a covering substrate formation glass plate, the process which forms an external electrode in the periphery, and the process which forms the printing electrode subsequently to an external electrode connected with an external circuit.

[0009]

[Function] In this configuration, since the die bond resin which fixes the lead wire which connects a surface acoustic wave device and the lead to the exterior, and a surface acoustic wave device is not used, magnitude can be made small, and there will be neither generating of the inductance by lead wire nor emission of the gas from die bond resin, and a frequency drift will not arise, but electrical characteristics will be stabilized.

[0010] Moreover, in this approach, a package will also perform the ejection and the closure of an electrode to the exterior by forming an external electrode in the through tube prepared in the location which can form a glass covering substrate by anode plate junction by package on the component formation substrate in which many surface acoustic wave devices were formed, and is in agreement with the ejection electrode of a surface acoustic wave device.

[0011]

[Example]

(Example 1) One example of this invention is explained below.

[0012] As shown in drawing 1 , take out a surface acoustic wave device 1 with the IDT electrode 3 on the single crystal substrate 2 of a piezo electric crystal, and it is constituted from an anode plate joint 5 arranged so that an electrode 4 and these might be surrounded. The external electrode 10 which the insulating covering substrate 6 formed the opening section 8 and a through tube 9 in the glass plate 7, and was prepared in a through tube 9 and its periphery, It is considering as the configuration which consisted of printing electrodes 11

installed in the external electrode 10, and joined the ejection electrode 4 of a surface acoustic wave device 1 to the external electrode 10 of the covering substrate 6, and joined the anode plate joint 5 to the covering substrate 6, and closed the IDT electrode 3.

[0013] In this example, using Xtal as a single crystal substrate 2, each electrode formed thickness by 500nm by having been made from aluminum, and the soda glass near the coefficient of thermal expansion of Xtal was used for it as a glass plate 7.

[0014] The manufacture approach of above-mentioned surface-acoustic-waves equipment is explained below. First, as shown in drawing 2 , many surface acoustic wave devices 1 which have the anode plate joint 5 which took out with the IDT electrode 3 and was arranged on the single crystal substrate 2 of the large number at an electrode 4 and its periphery at the component formation substrate 12 are formed. The anode plate joint 5 is connected with the anode plate junction terminal 13 to which each was all connected in common while it is formed in the periphery of a surface acoustic wave device 1. Especially the number is not restrained although two anode plate junction terminals 13 are formed by this example.

[0015] Moreover, as shown in drawing 3 , many the opening sections 8 and through tubes 9 are made in the location which is equivalent to the covering substrate formation glass plate 14 at each surface acoustic wave device 1.

[0016] Subsequently, as shown in drawing 4 and drawing 5 , alignment is carried out so that the ejection electrode 4 of the surface acoustic wave device 1 of the component formation substrate 12 and the through tube 9 of the covering substrate formation glass plate 14 may be in agreement, respectively. After sticking the component formation substrate 12 and the covering substrate formation glass plate 14, while impressing the electrical potential difference of 500V between the anode plate junction terminal 13 of the component formation substrate 12, and the covering substrate formation glass plate 14, the whole is heated at 350 degrees C and anode plate junction of both is carried out. Since

especially constraint does not have the electrode contacted on the covering substrate formation glass plate 14 in a location, it goes across the anode plate joint 5 all over the component formation substrate 12 and it connects with the anode plate junction terminal 13, all the surface acoustic wave devices 1 are joinable to the covering substrate formation glass plate 14 in several minutes. Then, the printing electrode 11 which the 1st layer forms Ti film (thickness: 50nm), and the 2nd layer forms the external electrode 10 of Cu film (thickness: 2 micrometers) in a through tube 9 and its periphery, prints the paste which subsequently made Cu the subject, and is soldered to a printed circuit board by sputtering in the inside of vacuum devices as shown in drawing 6 is formed. Since the thickness of the ejection electrode 4 and the electrode of the anode plate joint 5 is the same and a clearance is hardly generated between the ejection electrode 4 and a through tube 9, a flow and sufficient closure are made with the external electrode 10 formed by sputtering. After processing even an above-mentioned process collectively, it considers as the surface-acoustic-waves equipment of the anode plate joint 5 which cut the core with the dicing saw mostly and was shown in drawing 1 .

[0017] As mentioned above, according to this example, the printing electrode 11 realizes ejection of the conductor to the closure and the exterior of a surface acoustic wave device 1 through anode plate junction on the glass of the covering substrate 6, and the aluminum film of the anode plate joint 5 of a surface acoustic wave device 1, and the external electrode 10 of a through tube 9, and it sets to the manufacture approach. Since aluminum wire, die bond resin, etc. for connection are not used like the conventional example while being able to perform man day reduction and a miniaturization as compared with the conventional example, since the ejection of the closure and the external electrode 10 can be processed collectively, the stability of electrical characteristics can be improved.

[0018] (Example 2) The 2nd example of this invention is explained below.

[0019] As shown in drawing 7 , this example uses the printing electrode 11 of an

example 1 as a lead terminal 15 at the configuration of the above-mentioned example 1, and is taken as the configuration equipped with the electromagnetic shielding film 16 and mold resin 17.

[0020] Moreover, the manufacture approach is an approach that the process which performs anode plate junction to the component formation substrate 12 of the above-mentioned example 1 and the covering substrate formation glass plate 14, and forms the external electrode 10 by sputtering is the same. Then, a dicing saw cuts and the electromagnetic shielding film 16 which covered with printing the paste which made silver the subject is formed in the exterior of a surface acoustic wave device 1. Although this electromagnetic shielding film 16 is not illustrated, it is connected with the grounding terminal section of the external electrode 10.

[0021] Subsequently, after joining a lead terminal 15 to the external electrode 10 by welding, the whole is packed by mold resin 17 and it considers as surface-acoustic-waves equipment.

[0022] having formed the electromagnetic shielding film 16 in the external surface of a surface acoustic wave device 1 as mentioned above according to this example -- the effectiveness of the above-mentioned example 1 -- in addition, the electromagnetism from the outside -- mass-production nature can improve further by could maintain the property good [without being influenced of a noise], and having adopted the package by mold resin 17.

[0023] (Example 3) The 3rd example of this invention is explained below.

[0024] As shown in drawing 8 , this example is taken as the covering substrate 18 which does not have the opening section 8 of the covering substrate 6 of an example 1 in the configuration of the above-mentioned example 1, the ejection electrode 4 of a surface acoustic wave device 1, the surface acoustic wave device 19 to which the thickness of the anode plate joint 5 was made to increase by about 3 micrometers, and the configuration equipped with the electromagnetic shielding film 16. That is, by the ejection electrode 4 and the anode plate joint 5 which thickened thickness, since a clearance is made between the IDT electrode

3 and the covering substrate 18, the opening section 8 of the covering substrate 6 of the above-mentioned example 1 becomes unnecessary.

[0025] Moreover, the manufacture approach formed the external electrode 10 to the anode plate joint 5 and a through tube 9 by the same manufacture approach as the above-mentioned example 1 using an above-mentioned surface acoustic wave device 19 and the above-mentioned covering substrate 18. Moreover, after forming the printing electrode 11 similarly, a dicing saw cuts and the electromagnetic shielding film 16 which covered the external surface of a surface acoustic wave device 19 like the above-mentioned example 2 is formed by printing.

[0026] according to this example as mentioned above -- the effectiveness of the above-mentioned example 1 -- in addition , the electromagnetism from the outside -- since it take out even if it can reduce a processing man day and a curvature and a wave be in the component formation substrate 12 or the covering substrate formation glass plate 14 further , since a property good [without be influence of a noise] can be maintain and it be necessary to prepare the opening section in the covering substrate 18 , and it can absorb with the thickness of an electrode 4 , the dependability of closure junction improve greatly

[0027] In addition, although the surface acoustic wave device 1 was explained about this example 1 thru/or 3, it cannot be overemphasized that it is applicable also about each component, such as a resonator, an oscillator, or a filter. Moreover, since it is the configuration which joins by anode plate junction on the aluminum film and glass which were formed in the front face, and is closed As a single crystal substrate 2, not only the Xtal substrate but lithium tantalate (LiTa 2O3), The single crystal substrates 2, such as a lithium NAIO bait (LiNb 2O3) or a lithium DIBO rate (Li2B 4O6), are usable, and it is usable also about the configuration in which it was not restrained by the single crystal substrate 2, but the piezo electric crystal thin film and the IDT electrode 3 were further formed on the glass plate 7.

[0028] Moreover, the same junction is possible not only for the aluminum film

pure as an electrode material of the anode plate joint 5 but the aluminum film containing an impurity, and the aluminum film containing Cu, Ti, Pd, Sc, Zr, Si, etc. which are added for the purpose of endurance strengthening of a surface acoustic wave device 1 is also usable.

[0029]

[Effect of the Invention] If this invention is taken out with an IDT electrode and it has an electrode and an anode plate joint so that clearly also from the above explanation It has the covering substrate made from a glass plate which has the external electrode prepared in the through tube made in the location which is in agreement with the ejection electrode of a surface acoustic wave device. The configuration which connected the ejection electrode electrically, and joined the glass substrate and the anode plate joint, and closed the IDT electrode, Moreover, many surface acoustic wave devices which have the anode plate joint which consists of film which uses as a principal component the aluminum which took out with the IDT electrode and was prepared in an electrode and its whole perimeter are arranged. And the process which creates the component formation substrate which has the anode plate junction terminal which all anode plate joints were connected, and it was pulled out by the field in which the surface acoustic wave device is not formed, and was prepared, The process which creates the covering substrate formation glass plate which has the through tube of a large number made in the location which is in agreement with each ejection electrode of a surface acoustic wave device, After carrying out alignment of the ejection electrode of a component formation substrate, and the through tube of a covering substrate formation glass plate and sticking them, The process which heats the whole, bundles up the anode plate joint of a surface acoustic wave device, and is joined to a covering substrate formation glass plate while impressing an electrical potential difference between a covering substrate formation glass plate and an anode plate joint, The component formation substrate and covering substrate formation glass plate which were joined subsequently, by sputtering in the inside of a vacuum By the through tube of a covering substrate formation glass plate,

the process which forms an external electrode in the periphery, the process which forms a printing electrode subsequently to an external electrode, and the manufacture approach of subsequently having the process of an anode plate joint which cuts a core mostly A manufacturing cost is cheap and the surface-acoustic-waves equipment which was excellent in the property by which frequency characteristics did not change and were stabilized, and its manufacture approach can be realized.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The sectional view of the surface-acoustic-waves equipment of the 1st example of this invention

[Drawing 2] The important section perspective view of the component formation substrate in the manufacture approach of this surface-acoustic-waves equipment

[Drawing 3] The perspective view of the covering substrate formation glass plate in this manufacture approach

[Drawing 4] The sectional view showing the junction condition of a component formation substrate and a covering substrate formation glass plate in this

manufacture approach

[Drawing 5] The decomposition perspective view of each surface acoustic wave device of drawing 4 , and each covering substrate

[Drawing 6] The sectional view showing the formation condition of an external electrode and a printing electrode in this manufacture approach

[Drawing 7] The sectional view of the surface-acoustic-waves equipment of the 2nd example of this invention

[Drawing 8] The sectional view of the surface-acoustic-waves equipment of the 3rd example of this invention

[Drawing 9] The sectional view of conventional surface-acoustic-waves equipment

[Description of Notations]

1 Surface Acoustic Wave Device

3 INTADIJITARU Transducer Electrode

4 Ejection Electrode

5 Anode Plate Joint

6 Covering Substrate

8 Opening Section

9 Through Tube

10 External Electrode

11 Printing Electrode

[Translation done.]

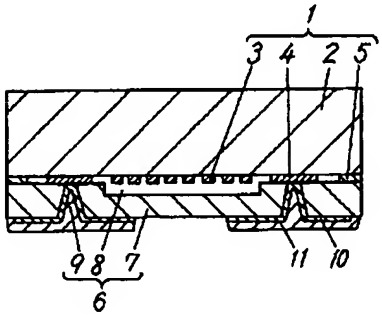
2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

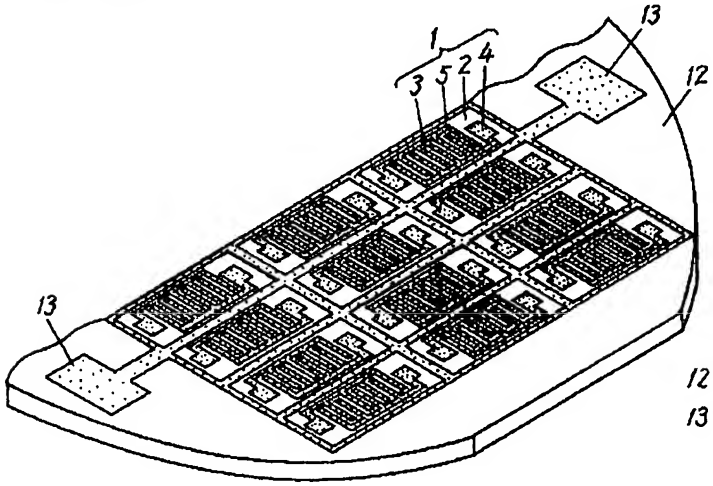
DRAWINGS

[Drawing 1]

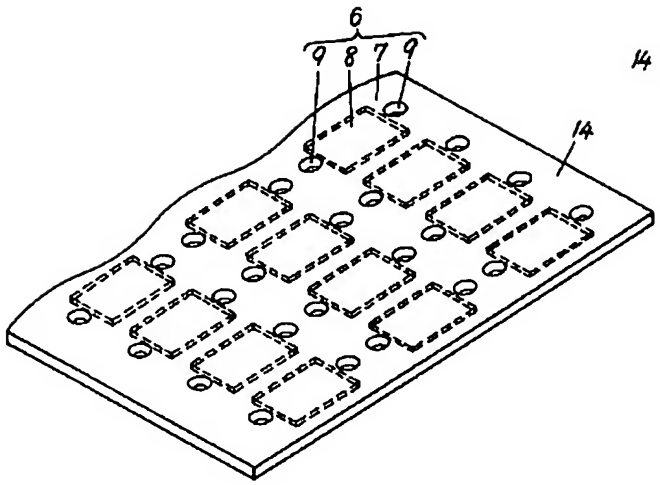
1 表面弾性波素子
3 インターディジタルトランスデューサ電極
4 取り出し電極
5 陽極接合部
6 カバー基板
8 空隙部
9 貫通孔
10 外部電極
11 印刷電極



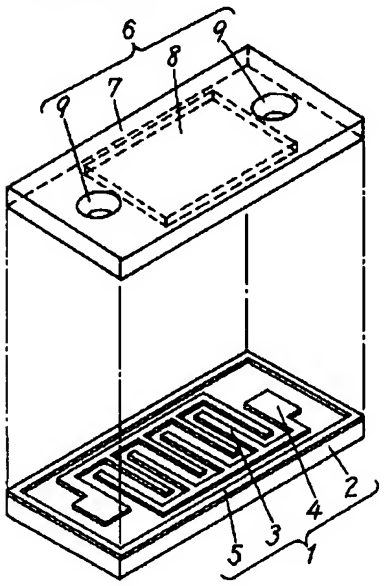
[Drawing 2]



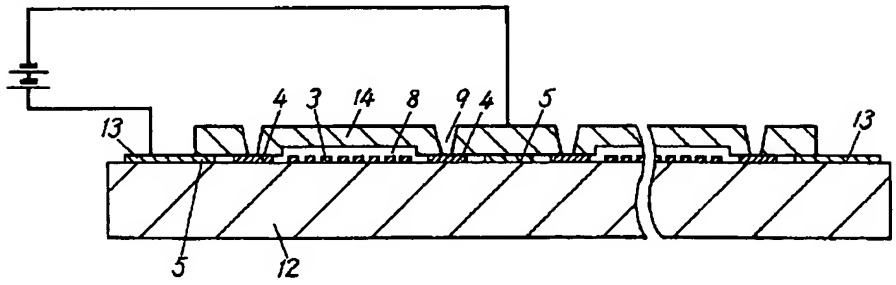
[Drawing 3]



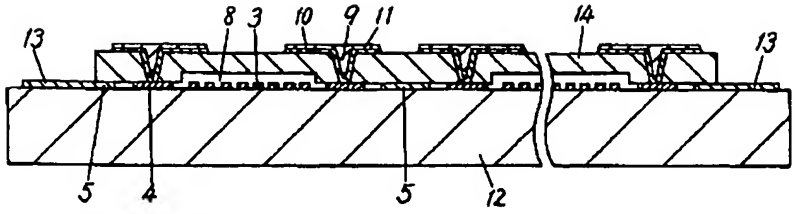
[Drawing 5]



[Drawing 4]

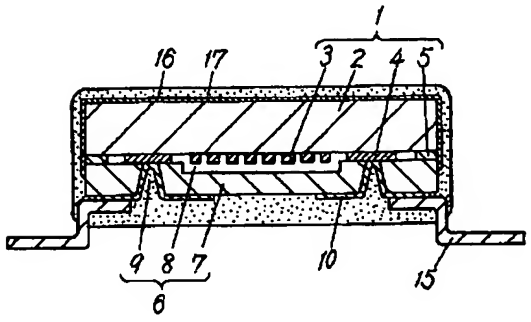


[Drawing 6]



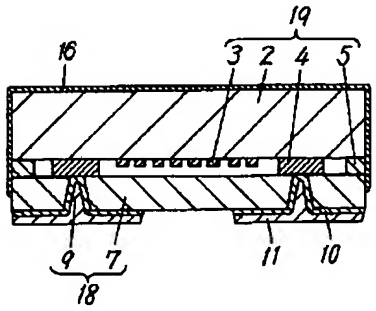
[Drawing 7]

15 リード端子
16 電磁シールド膜
17 モールド樹脂

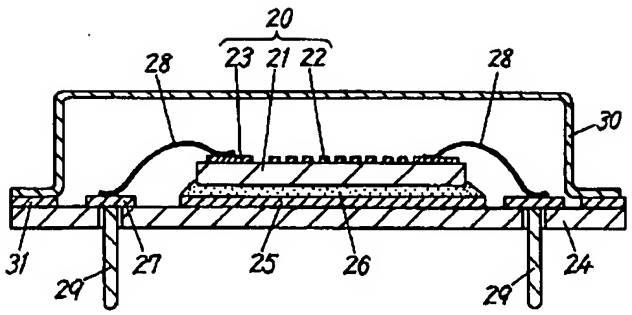


[Drawing 8]

18 カバー基板
19 表面弾性波素子



[Drawing 9]



[Translation done.]

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	3/08		7259－5Ｊ		
	9/145	Ｚ	7259－5Ｊ		

審査請求　未請求　請求項の数４　ＯＬ　（全６頁）

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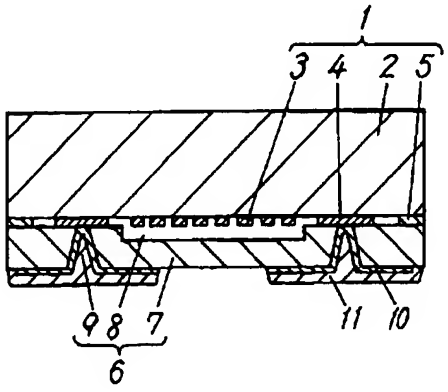
(54)【発明の名称】　表面弾性波装置及びその製造方法

(57)【要約】

【目的】　電子機器に用いられる表面弾性波装置において、小型で製造コストが安く、電気的特性を安定化することを目的とする。

【構成】　表面にインターディジタルトランスデューサ電極３と取り出し電極４と陽極接合部５とを有する表面弾性波素子１と、取り出し電極４と一致する位置に形設した貫通孔９に設けた外部電極１０を有するカバー基板６を備え、取り出し電極４と外部電極１０を接続し、かつカバー基板６と陽極接合部５とを接合して封止した。

1 表面弾性波素子
3 インターディジタルトランスデューサ電極
4 取り出し電極
5 陽極接合部
6 カバー基板
8 空隙部
9 貫通孔
10 外部電極
11 印刷電極



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【特許請求の範囲】

【請求項１】　表面に表面弾性波を励振・受信するインターディジタルトランスデューサ電極と取り出し電極とその周囲全体に配設したアルミニウムを主成分とする膜よりなる陽極接合部とを有する表面弾性波素子と、前記表面弾性波素子の取り出し電極と一致する位置に形設した貫通孔に設けた外部電極と印刷電極を有し、かつ前記表面弾性波素子と対向する面に空隙部を形設した絶縁性のカバー基板を備え、前記取り出し電極と前記外部電極を電気的に接合し、かつ、前記カバー基板と前記陽極接合部を接合して封止したことを特徴とする表面弾性波装置。

【請求項２】　表面に表面弾性波を励振・受信するインターディジタルトランスデューサ電極と取り出し電極とその周囲全体に配設したアルミニウムを主成分とする膜よりなる陽極接合部とを有する表面弾性波素子と、前記表面弾性波素子の取り出し電極と一致する位置に形設した貫通孔に設けた外部電極を有し、かつ前記表面弾性波素子と対向する面に空隙部を形設した絶縁性のカバー基板を備え、前記取り出し電極と前記外部電極を電気的に接合し、かつ、前記カバー基板と前記陽極接合部を接合して封止し、前記外部電極にリード端子を接合した後、前記表面弾性波素子の外面に電磁シールド膜を被覆し、全体をモールド樹脂でパッケージしたことを特徴とする表面弾性波装置。

【請求項３】　表面に表面弾性波を励振・受信するインターディジタルトランスデューサ電極と取り出し電極とその周囲全体に配設したアルミニウムを主成分とする膜よりなる陽極接合部とを有する表面弾性波素子と、前記表面弾性波素子の取り出し電極と一致する位置に形設した貫通孔に設けた外部電極を有する絶縁性のカバー基板を備え、前記取り出し電極と前記外部電極を電気的に接合し、かつ、前記カバー基板と前記陽極接合部を接合して封止し、前記表面弾性波素子の外面に電磁シールド膜を被覆したことを特徴とする表面弾性波装置。

【請求項４】　表面に表面弾性波を励振・受信するインターディジタルトランスデューサ電極と取り出し電極とその周囲全体に配設したアルミニウムを主成分とする膜よりなる陽極接合部とを有する表面弾性波素子を多数配置し、かつ、前記陽極接合部がすべて接続されて、前記表面弾性波素子が形成されていない領域に引き出されて設けた陽極接合端子を有する素子形成基板を作成する工程と、前記表面弾性波素子のそれぞれの取り出し電極と一致する位置に形設した多数の貫通孔を有するカバー基板形成ガラス板を作成する工程と、前記素子形成基板の取り出し電極と前記カバー基板形成ガラス板の貫通孔とを位置合わせして密着させた後、前記カバー基板形成ガラス板と前記素子形成基板の陽極接合端子との間に電圧を印加するとともに全体を加熱して、前記表面弾性波素子の陽極接合部を一括して前記カバー基板形成ガラス板

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に接合する工程と、ついで接合された前記素子形成基板と前記カバー基板形成ガラス板を真空装置中でのスパッタリングにより、前記カバー基板形成ガラス板の貫通孔とその周辺部に外部電極を形成する工程と、ついで前記外部電極に外部回路と接続する印刷電極を形成する工程と、ついで前記陽極接合部のほぼ中心部を切断する工程とを有する表面弾性波装置の製造方法。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、テレビ、ＶＴＲや携帯電話等の移動体通信機器に用いられる表面弾性波装置及びその製造方法に関する。

【０００２】

【従来の技術】以下に従来の表面弾性波装置について説明する。

【０００３】図９に示すように、表面弾性波素子２０は、一般に圧電体の単結晶基板２１上に表面波を励振・受信する機能を有したインターディジタルトランスデューサ（以下、ＩＤＴという）電極２２とＩＤＴ電極２２に通電するための取り出し電極２３を有し、ステム２４のアース電極２５上にダイボンド樹脂２６により装着、固定されている。取り出し電極２３と端子電極２７とは、接続用のＡｌワイヤ２８でワイヤボンド方式により電気的に接続されている。なお、Ａｌワイヤ２８に代えて、Ａｕワイヤを用いることもある。端子電極２７は端子２９に接続されており、外部回路と接続できる構成である。

【０００４】表面弾性波装置は、表面波の伝搬特性を利用しているので、表面を保護膜で被覆することができず、ＩＤＴ電極２２の表面に空間を有する構成としている。すなわち、表面弾性波素子２０とＡｌワイヤ２８に接触せず、かつ、外部と気密を保つ構成としたキャップ３０をかぶせて、その周辺部をシーム溶接してシーム溶接部３１を形成して、封止した構成である。

【０００５】

【発明が解決しようとする課題】しかしながら上記の従来の構成では、シーム溶接による封止により信頼性は高いが、一括して溶接することができないので、工数がかかり製造コストが高くなるという問題点、また、表面弾性波装置をプリント基板に実装するときの加熱により、ダイボンド樹脂２６からガスが放出されて周波数特性を変化させるという問題点、さらに、高周波帯域で使用するときには、Ａｌワイヤ２８がインダクタとして作用して、Ａｌワイヤ２８の張り方によってインダクタンスが変化するので、周波数特性が不安定であるという問題点を有していた。

【０００６】本発明は上記従来の問題点を解決するもので、製造コストが安く、周波数特性が変化せず、安定した特性の表面弾性波装置及びその製造方法を提供することを目的とする。

【0007】

【課題を解決するための手段】この目的を達成するために本発明の表面弾性波装置は、表面に表面弾性波を励振・受信するＩＤＴ電極と取り出し電極と陽極接合部とを有する表面弾性波素子と、表面弾性波素子の取り出し電極と一致する位置に形設した貫通孔に設けた外部電極を有するガラス板製のカバー基板を備え、取り出し電極と外部電極を電気的に接続し、かつガラス基板と陽極接合部とを接合してＩＤＴ電極を封止した構成としたものである。

【0008】また、その製造方法は、表面に表面弾性波を励振・受信するＩＤＴ電極と取り出し電極とその周囲全体に配設したアルミニウムを主成分とする膜よりなる陽極接合部を有する表面弾性波素子を多数配置し、かつ、陽極接合部がすべて接続されて表面弾性波素子が形成されていない領域に引き出されて設けた陽極接合端子を有する素子形成基板を作成する工程と、表面弾性波素子のそれぞれの取り出し電極と一致する位置に形設した多数の貫通孔を有するカバー基板形成ガラス板を作成する工程と、素子形成基板の取り出し電極とカバー基板形成ガラス板の貫通孔とを位置合わせして密着させた後、カバー基板形成ガラス板と陽極接合部との間に電圧を印加するとともに全体を加熱して表面弾性波素子の陽極接合部を一括してカバー基板形成ガラス板に接合する工程と、ついで接合された素子形成基板とカバー基板形成ガラス板を真空装置中でのスパッタリングにより、カバー基板形成ガラス板の貫通孔とその周辺部に外部電極を形成する工程と、ついで外部電極に外部回路と接続する印刷電極を形成する工程と、ついで陽極接合部のほぼ中心部を切断する工程とを有するものである。

【0009】

【作用】この構成において、表面弾性波素子と外部へのリードとを接続するリード線や表面弾性波素子を固定するダイボンド樹脂を用いないので、大きさを小さくでき、かつリード線によるインダクタンスの発生やダイボンド樹脂からのガスの放出がなくて、周波数変動が生じず、電気的特性が安定することとなる。

【0010】また、この方法において、表面弾性波素子を多数形成した素子形成基板上にガラス製のカバー基板を一括で陽極接合により形成でき、かつ表面弾性波素子の取り出し電極と一致する位置に設けた貫通孔に外部電極を形成することで外部への電極の取り出しと封止も一括で行うこととなる。

【0011】

【実施例】

（実施例１）以下本発明の一実施例について説明する。

【0012】図１に示すように、表面弾性波素子１は、圧電体の単結晶基板２上にＩＤＴ電極３と取り出し電極４及びこれらを取り囲むように配設した陽極接合部５とで構成し、絶縁性のカバー基板６は、ガラス板７に空隙

部８と貫通孔９を形成し、貫通孔９とその周辺部に設けた外部電極１０と、外部電極１０に添設した印刷電極１１とで構成し、表面弾性波素子１の取り出し電極４をカバー基板６の外部電極１０と接合し、かつ、陽極接合部５をカバー基板６に接合してＩＤＴ電極３を封止した構成としている。

【0013】本実施例では、単結晶基板２として水晶を用い、各電極は、アルミニウムを材料として膜厚を５００ｎｍで形成し、ガラス板７としては、水晶の熱膨張係数に近いソーダガラスを用いた。

【0014】上述の表面弾性波装置の製造方法について、以下に説明する。まず、図２に示すように、素子形成基板１２に、その多数の単結晶基板２上にＩＤＴ電極３と取り出し電極４とその周辺部に配設した陽極接合部５を有する表面弾性波素子１を多数形成する。陽極接合部５は表面弾性波素子１の周辺部に形成されるとともに、それぞれがすべて共通に接続された陽極接合端子１３と接続されている。陽極接合端子１３は、本実施例では２個設けているが個数は特に制約されるものではない。

【0015】また、図３に示すように、カバー基板形成ガラス板１４に、個々の表面弾性波素子１に相当する位置に多数の空隙部８と貫通孔９を形設する。

【0016】ついで、図４及び図５に示すように、素子形成基板１２の表面弾性波素子１の取り出し電極４とカバー基板形成ガラス板１４の貫通孔９とがそれぞれ一致するように位置合わせして、素子形成基板１２とカバー基板形成ガラス板１４を密着させた後、素子形成基板１２の陽極接合端子１３とカバー基板形成ガラス板１４との間に５００Ｖの電圧を印加するとともに全体を３５０℃に加熱して両者を陽極接合する。カバー基板形成ガラス板１４の上に接触させる電極は、特に位置には制約はなく、陽極接合部５は、素子形成基板１２の全面に渡って陽極接合端子１３と接続されているので、すべての表面弾性波素子１を数分でカバー基板形成ガラス板１４に接合することができる。この後、真空装置中でのスパッタリングにより、図６に示すように、貫通孔９とその周辺部に第１層がＴｉ膜（膜厚：５０ｎｍ）、第２層がＣｕ膜（膜厚：２μｍ）の外部電極１０を形成し、ついでＣｕを主体としたペーストを印刷してプリント基板に半田付けする印刷電極１１を形成する。取り出し電極４と陽極接合部５の電極の膜厚が同一であるので、取り出し電極４と貫通孔９との間にほとんど隙間が生じないことから、スパッタリングで形成した外部電極１０で導通と充分な封止ができる。上述の工程までを一括して処理した後、陽極接合部５のほぼ中心部をダイシングソーで切断して、図１に示した表面弾性波装置とする。

【0017】以上のように本実施例によれば、表面弾性波素子１の封止及び外部への導体の取り出しをカバー基板６のガラスと表面弾性波素子１の陽極接合部５のアル

ミニウム膜との陽極接合及び貫通孔９の外部電極１０を介して印刷電極１１で実現し、その製造方法において、封止と外部電極１０の取り出しが一括して処理できるので、従来例に比して、工数低減と小型化ができるとともに、従来例のように接続用のＡｌワイヤーやダイボンド樹脂等を使用しないので、電気的特性の安定性を向上できる。

【００１８】（実施例２）以下本発明の第２の実施例について説明する。

【００１９】図７に示すように、本実施例は前述実施例１の構成に、実施例１の印刷電極１１をリード端子１５とし、電磁シールド膜１６及びモールド樹脂１７を備えた構成としている。

【００２０】また、その製造方法は、前述実施例１の素子形成基板１２とカバー基板形成ガラス板１４との陽極接合を行い、スパッタリングで外部電極１０を形成する工程までは同一の方法である。その後、ダイシングソーで切断し、表面弾性波素子１の外部に銀を主体としたペーストを印刷により被覆した電磁シールド膜１６を形成する。この電磁シールド膜１６は図示していないが外部電極１０のアース端子部と接続されている。

【００２１】ついで、リード端子１５を外部電極１０に溶接により接合した後、全体をモールド樹脂１７でパッケージして表面弾性波装置とする。

【００２２】以上のように本実施例によれば、電磁シールド膜１６を表面弾性波素子１の外面に設けたことにより、前述実施例１の効果に加えて、外部からの電磁ノイズの影響を受けずに良好な特性を維持でき、また、モールド樹脂１７によるパッケージを採用したことにより、量産性がさらに向上できる。

【００２３】（実施例３）以下本発明の第３の実施例について説明する。

【００２４】図８に示すように、本実施例は前述実施例１の構成に、実施例１のカバー基板６の空隙部８のないカバー基板１８と、表面弾性波素子１の取り出し電極４と陽極接合部５の膜厚を約３μｍ増加させた表面弾性波素子１９と、電磁シールド膜１６を備えた構成としている。すなわち、膜厚を厚くした取り出し電極４と陽極接合部５によって、ＩＤＴ電極３とカバー基板１８との間に隙間ができるので、前述実施例１のカバー基板６の空隙部８は不要となる。

【００２５】また、その製造方法は、上述の表面弾性波素子１９とカバー基板１８を用いて、前述実施例１と同様な製造方法により陽極接合部５と貫通孔９への外部電極１０の形成を行った。また、印刷電極１１を同様に形成した後、ダイシングソーで切断し、前述実施例２と同様に表面弾性波素子１９の外面を被覆した電磁シールド膜１６を印刷で形成する。

【００２６】以上のように本実施例によれば、前述実施例１の効果に加えて、外部からの電磁ノイズの影響を受

けずに良好な特性を維持でき、また、カバー基板１８に空隙部を設けなくてもよいので、加工工数を減らすことができ、さらに、素子形成基板１２やカバー基板形成ガラス板１４に反りやうねりがあっても取り出し電極４の厚さにより吸収できるので、封止接合の信頼性を大きく向上できる。

【００２７】なお、本実施例１ないし３については、表面弾性波素子１について説明したが、共振器や発振器、あるいはフィルター等の各素子についても適用できることはいうまでもない。また、表面に形成されたアルミニウム膜とガラスとの陽極接合により接合して封止する構成であるので、単結晶基板２として水晶基板のみでなく、リチウムタンタレート（$LiTa_2O_3$）、リチウムナイオベート（$LiNb_2O_3$）あるいはリチウムディボレート（$Li_2B_4O_6$）等の単結晶基板２が使用可能であり、さらに、単結晶基板２に制約されずガラス板７上に圧電体薄膜とＩＤＴ電極３が形成された構成についても使用可能である。

【００２８】また、陽極接合部５の電極材料としては純粋なアルミニウム膜のみでなく、不純物を含むアルミニウム膜でも同様な接合が可能であり、表面弾性波素子１の耐久性強化の目的で添加されているＣｕ，Ｔｉ，Ｐｄ，Ｓｃ，Ｚｒ，Ｓｉ等を含むアルミニウム膜でも使用可能である。

【００２９】

【発明の効果】以上の説明からも明らかなように本発明は、ＩＤＴ電極と取り出し電極と陽極接合部を有すると、表面弾性波素子の取り出し電極と一致する位置に形設した貫通孔に設けた外部電極を有するガラス板製のカバー基板を備え、取り出し電極を電気的に接続し、かつ、ガラス基板と陽極接合部とを接合してＩＤＴ電極を封止した構成、また、ＩＤＴ電極と取り出し電極とその周囲全体に設けたアルミニウムを主成分とする膜よりなる陽極接合部を有する表面弾性波素子を多数配置し、かつ、陽極接合部がすべて接続されて表面弾性波素子が形成されていない領域に引き出されて設けた陽極接合端子を有する素子形成基板を作成する工程と、表面弾性波素子のそれぞれの取り出し電極と一致する位置に形設した多数の貫通孔を有するカバー基板形成ガラス板を作成する工程と、素子形成基板の取り出し電極とカバー基板形成ガラス板の貫通孔とを位置合わせして密着させた後、カバー基板形成ガラス板と陽極接合部との間に電圧を印加するとともに全体を加熱して表面弾性波素子の陽極接合部を一括してカバー基板形成ガラス板に接合する工程と、ついで接合された素子形成基板とカバー基板形成ガラス板を真空中でのスパッタリングにより、カバー基板形成ガラス板の貫通孔とその周辺部に外部電極を形成する工程と、ついで外部電極に印刷電極を形成する工程と、ついで陽極接合部のほぼ中心部を切断する工程とを有する製造方法により、製造コストが安く、周波数特性

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が変化せず、安定した特性の優れた表面弾性波装置及びその製造方法を実現できるものである。

【図面の簡単な説明】

【図１】本発明の第１の実施例の表面弾性波装置の断面図

【図２】同表面弾性波装置の製造方法における素子形成基板の要部斜視図

【図３】同製造方法におけるカバー基板形成ガラス板の斜視図

【図４】同製造方法における素子形成基板とカバー基板形成ガラス板の接合状態を示す断面図

【図５】図４の各表面弾性波素子と各カバー基板の分解斜視図

【図６】同製造方法における外部電極と印刷電極の形成状態を示す断面図

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【図７】本発明の第２の実施例の表面弾性波装置の断面図

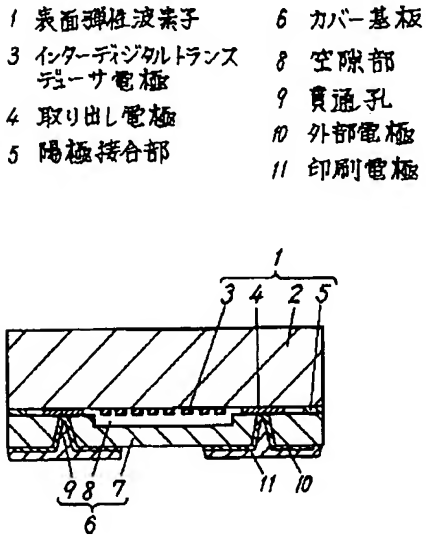
【図８】本発明の第３の実施例の表面弾性波装置の断面図

【図９】従来の表面弾性波装置の断面図

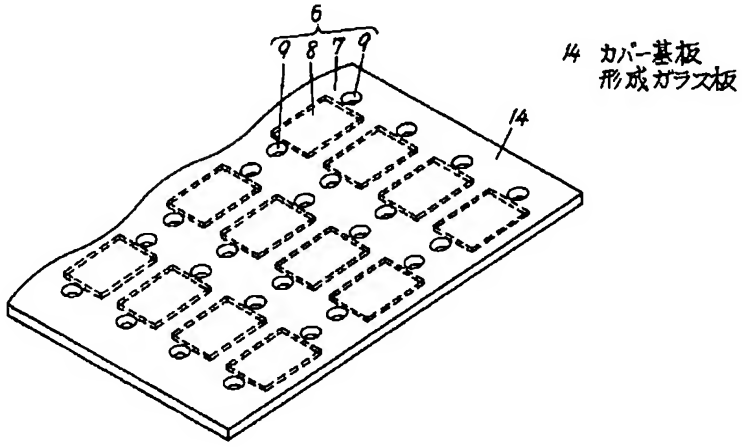
【符号の説明】

１　表面弾性波素子
３　インターディジタルトランスデューサ電極
４　取り出し電極
５　陽極接合部
６　カバー基板
８　空隙部
９　貫通孔
１０　外部電極
１１　印刷電極

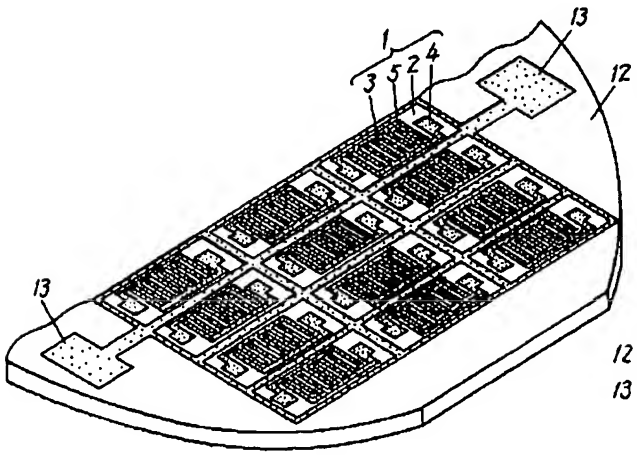
【図１】



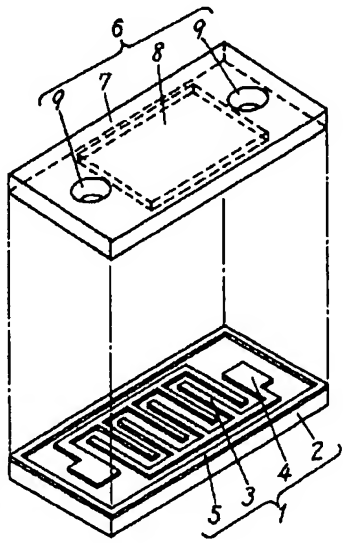
【図３】



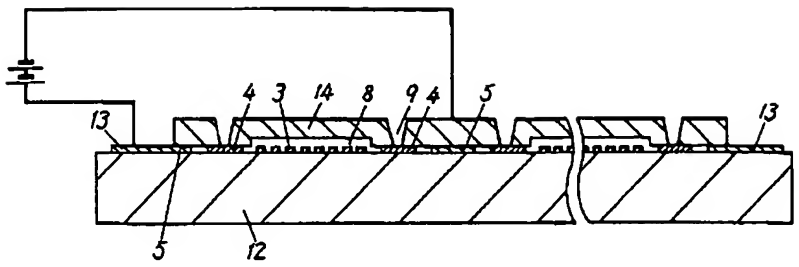
【図２】



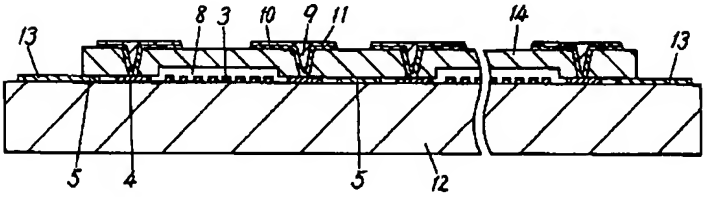
【図５】



【図4】

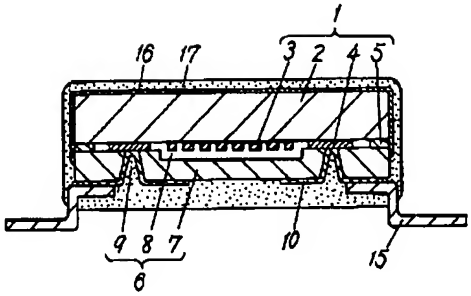


【図6】



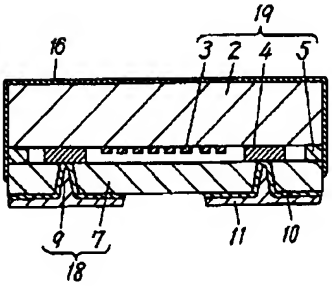
【図7】

15 リード端子
16 電磁シールド膜
17 モールド樹脂



【図8】

18 カバー基板
19 表面弾性波素子



【図9】